Application for

UNITED STATES LETTERS PATENT

Of

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For

SAILING DEVICE

Specification

BACKGROUND OF THE INVENTION

Field of the Invention:

The present invention relates to a sailing device suitable for use in a pleasure boat narrow in width such as a canoe, a kayak, a faltboat or the like, which is easily controlled without applying any inclination moment to the boat and capable of being unfolded and folded by simple operation of a user.

Prior Art:

In small sailboats such as a dinghy equipped with a mast fixedly mounted to the hull, the boat tends to be fallen down by an inclination moment acting thereon when received a side wind. In such an instance, the user leans windward out of the hull for balance against the inclination moment. In contrast with such sailboats, a pleasure boat narrow in width such as a canoe, a kayak, a faltboat or the like is weak against a side wind since a restoring force against traverse tilt is very small. Accordingly, as a large sail may not be set on the boat, a small sail such as a wrapping cloth is set on the boat perpendicularly to a direction of travel for sailing in a tailwind. To avoid such a problem caused by an inclination moment, proposed in Japanese Patent Laid-open Publication No. 8-168550 is a sailing device such as a kite lifted with a single string. The sailing device comprises a sail which is operated by means of a plurality of control lines connected thereto.

Problem to be solved:

In use of the sailing device proposed in Japanese Patent Laid-open Publication 8-168550, there will occur a difficulty in operation of the plural control lines. As the sail is indirectly operated through the plural control lines, it is difficult to cope with sudden change of a wind direction, and it is unable to rise the sail in a gentle wind. In addition, it is not easy to sail near the adverse wind, and it takes a time for a user to fold the sail on the boat. A primary object of the present invention is to solve the foregoing problems.

Means for solution of the problem and useful effects thereof:

According to the present invention, the object is accomplished by providing a sailing device suitable for use in a pleasure boat, which comprises a sail portion composed of a backbone, a pair of left and right spars extending obliquely backward from the fore end of the backbone and a sail-cloth attached at the fore edge thereof to the pair of left and right spars and at the aft end thereof to the aft end of the backbone, and a strut extending downward from the fore end of the backbone, the lower end of the strut being directly mounted on the boat hull for rise and fall or indirectly attached to the boat hull by support of a user. In use of the sailing device, an inclination moment applied to the boat hull becomes small even when received a side wind. Accordingly, a possibility of overturning would become extremely small even if the sail portion was enlarged. As the strut is supported by the user's hands in use of the

sailing device, the sail portion can be operated by the user in a stable condition even in a gentle wind. Additionally, as the sail portion is directly operated by the user, it is able to promptly cope with sudden change of the wind direction.

In the sailing device, it is preferable that left and right wing sections of the sail portion each are provided with a camber angle to enhance directional stability and controllability of the sail portion against the wind. In a practical embodiment of the sailing device according to the present invention, it is preferable that the left and right spars are connected at their one ends to the fore end of the backbone for tilt movement, a slider is mounted on an intermediate portion of the backbone for slide movement in a longitudinal direction of the backbone, left and right rods are pivoted at their one ends to each intermediate portion of the spars and at their other ends to the slider, and a lower rod is pivoted at its one end to an intermediate portion of the strut and at its other end to the slider, wherein the slider is moveable in the longitudinal direction of said backbone to extend the spars obliquely backward from the fore end of the backbone and to fold the spars along the backbone, the slider being engageable with a stopper hook fixed to the fore portion of the backbone when the strut is unfolded downward from the fore end of the backbone and is folded along said backbone. With such arrangement as described above, the sailing device can be easily folded when the wind has fallen or grown stronger.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

Fig. 1 is a perspective view illustrating the whole construction of a first embodiment of the present invention;

Fig. 2 is a perspective view of a slider;

Fig..3 is a perspective view of a stopper;

Fig. 4 is a perspective view illustrating a pivotal connection of a head block and a backbone;

Fig.5 is a perspective view of a handle;

Fig. 6 is a perspective view illustrating a pivotal connection of a pair of left and right spurs to the backbone;

Fig. 7 is a perspective view illustrating an attachment method of a sleeve to the spars and a strut;

Fig. 8 is a perspective view of an end-piece;

Fig. 9 is a perspective view of an adaptor;

Fig. 10 is a perspective view of an aft portion of a sail cloth fastened to the backbone;

Fig. 11 is a perspective view of a modification of the slider;

Fig. 12 is a perspective view of a top-piece shown obliquely from a lower side;

Fig. 13 is a perspective view illustrating the whole construction of a second embodiment of the present invention;

Fig. 14 is a perspective view of an aft section of the sail portion;

Fig. 15 is a perspective view illustrating a modification of the aft section of the sail portion in the second embodiment;

Fig. 16 is a side view illustrating a function of the sailing device according to the present invention in a tailwind;

Figs. 17(a), (b) and (c) are plan views illustrating a function of the sailing device according to the present invention in respective wind directions; and

Fig. 18 is a side view illustrating a training condition with the sailing device on the ground.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, a sailing device according to a first embodiment of the present invention will be described with reference to Figs. 1~10. As shown in Fig. 1, the sailing device comprises a sail portion A composed of a backbone 1, a pair of left and right spars 3a, 3b extending obliquely backward from the fore end of backbone 1, and a sail cloth 8 attached at the fore edge thereof to the pair of left and right spars and at the aft end thereof to the aft end of backbone 1, and a strut 4 extending downward from the fore end of backbone 1. The sail portion A has left- and right-hand wing sections applied with a camber angle. In a condition where the backbone 1 is seen from its aft side toward its fore end, a wing section located at the right side is defined as the right wing section, while a wing section located at the left side is defined as the left wing section. In the sailing device, it is desirable that the backbone 1, spurs 3a, 3b and strut 4 each are in the form of a thin pipe made of light-weight high-strength

material such as a high-strength and anti-corrosive aluminum alloy or carbon fiber reinforced plastic.

As shown in Figs. 1 and 3, a tubular stopper 9 is fixed to the fore end of backbone 1. A stopper lug 9c is fixed to the lower side of stopper 9, and a stopper hook 9b is hingedly connected to the stopper lug 9c at its base by means of a pin 9d. A stopper rubber 9a is hooked with the stopper hook 9b and tubular stopper 9 so that the stopper hook 9b is pressed toward the backbone 1. The stopper 9 is fixed to the backbone 1 by means of an adhesive tape D. The stopper 9 may be fixed to the backbone 1 by means of a bolt and a nut through a washer or a fastening fixture. The stopper lug 9c may be directly provided on the backbone 1. As shown in Fig. 2, the aft portion of backbone 1 is inserted into a cylindrical slider 2 which is provided at its periphery with lugs 2a, 2b, 2c fixed thereto and at its fore end with a flange 2d fixed thereto.

As shown in Figs. 1 and 6, the spars 3a, 3b each are provided at their one ends with hinge brackets 3g, 3h fixed thereto and are hingedly connected at their one ends to the fore end portion of backbone 1 by means of pins 3i, 3j inserted into respective holes of the hinge brackets 3g, 3h aligned with corresponding holes of the fore end portion of backbone 1 and fixed in position by means of split pins and washers. With the hinge brackets 3g, 3h, the spars 3a, 3b are hinged to be movable between a position extending obliquely backward from the fore end of backbone 1 and a position folded

along the backbone 1.

As shown in Fig. 7, sleeves 3c, 3d coupled with the spars 3a, 3b are provided with lugs 3e, 3f fixed thereto respectively. Left and right rods 5b, 5c are hingedly connected at their one ends to the lugs 2b, 2c of slider 2 and at their other ends to the lugs 3e, 3f of spurs 3a, 3b respectively. The lugs 3e and 3f are connected by means of a cable or rope 13c which cooperates with left and right tension ropes 13a, 13b to maintain the camber angle of left and right spars 3a, 3b. The left and right sleeves 3c, 3d are useful as reinforcement of the spars 3a, 3b at a portion applied with a maximum force. As the lugs 3e, 3f are moved by displacement of the sleeves 3c, 3d, the mounting positions of left and right rods 5b, 5c can be adjusted in necessity. Although in this embodiment, the left and right sleeves 3c, 3d are obliquely cut at their opposite ends and attached to the spars 3a, 3b by means of an adhesive tape D wound there on, the sleeves 3c, 3d may be fixed to the spars 3a, 3b by means of bolts passed therethrough and fastened by nuts.

The left and right spurs 3a, 3b are inserted into sheath portions formed at the front edges of sail cloth 8. As shown in Fig. 8, an end-piece 25 is coupled with each distal end of the left and right spurs 3a, 3b and fixed in position by means of an adhesive tape D. The distal ends of front edges of sail cloth 8 are hooked to a bifurcated end of the end-piece 25 by means of an end-rubber 28. Similarly, the aft end of sail cloth 8 is hooked to a bifurcated end of an end-piece 25 fixedly coupled

with the aft end of backbone 1 by means of an end-rubber 28. Thus, the sail cloth 8 is applied with an appropriate tension force in longitudinal and lateral directions.

As shown in Figs. 1 and 10, the sail cloth 8 is provided at its central aft portion with ear tabs 8e, 8f which are connected to the backbone 1 by means of a rope in accordance with magnitude of wind to enhance longitudinal stability of the sailing device and to adjust a propulsive force. In stead of the ear tabs 8e, 8f, the sail cloth 8 may be directly connected to the backbone 1 by means of a rope. As is understood from the above description, the left and right spars 3a, 3b of the sail portion A are provided with a camber angle so that the left and right wing sections of the sail portion A are applied with a camber angle.

As shown in Fig. 4, the strut 4 for support of the sail portion A is provided at its upper end with a head block 14 bolted thereon. The head block 14 is connected to the backbone 1 by means of a bolt 14d inserted into holes of the head block 14 aligned with corresponding a hole of backbone 1 at a backside of the mounting holes of the spurs 3a, 3b and fastened by a nut through a washer. With such connection of the head block 14, the strut 4 is hingedly connected to the backbone 1 to be movable between a position extending downward from the fore end of backbone 1 and a position folded along the backbone 1.

As shown in Fig. 7, a sleeve 4b coupled with an intermediate portion of strut 4 is provided with a lug 4a which is hingedly connected to one end of the lower rod 5a hinged at its other end to the lug 2a of slider 2 described above. The sleeve 4b is useful as reinforcement of the strut 4 at a portion applied with a maximum force. As the lug 4a is moved by displacement of the sleeve 4b, the hinged portion of lower rod 5a can be adjusted in necessity for slight adjustment of a folding position. Although in this embodiment, the sleeve 4b is obliquely cut at their opposite ends as well as the left and right sleeves 3c, 3d and attached to the strut 4 by means of an adhesive tape D wound there on, the sleeve 4 may be fixed to the strut 4 by means of bolts passed therethrough and fastened by nuts.

As shown in Fig. 5, a handle bracket 6c composed of diamond-shaped aluminum plates is fixed to the strut 4 in such a manner to sandwich a lower portion of the strut 4 at a position suitable for operation of a user. Front and rear handles 6a, 6b are hinged to the opposite ends of handle bracket 6c by means of bolts 6h. Stopper bolts 6d, 6e are fastened to upper front and rear portions of the handle bracket 6c to restrict downward movement of the handles 6a, 6b by abutment with them when they are folded downwardly and to permit upward movement of the handles 6a, 6b when they are folded upwardly. Thus, the handles 6a, 6b each are retained at a lateral position perpendicular to the strut 4 and at a position folded upwardly along the strut 4. Left and right tension ropes 13a, 13b are fastened at their one ends to holes 6f, 6g of handle bracket 6c and at their other ends to the lugs 3e, 3f of spurs 3a, 3b. The tension

ropes 13a, 13b cooperate with the upper tension rope 13c to stabilize and reinforce the sailing device in construction. A tail rope 19 is fastened at its one end to the distal end of rear handle 6b and at its other end to an end-piece 25 fixedly coupled with the aft end of backbone 1 to prevent the backbone 1 of sail portion A from bending caused by wind. The tail rope 19 may be fastened at its one end to a lower portion of strut 4.

In use of the sailing device, the lower end of strut 4 is attached to an adaptor B fastened to a user as shown in Fig. 9. The adaptor B includes a belt 30 for attachment with a user, a holder 30a fixed to the belt 30, and a socket 30b attached to the holder 30a for rotary movement about a lateral axis. A joint ball 10 is secured to the lower end of strut 4. In a condition where the joint ball 10 of strut 4 has been received by the socket 30b, both the handles 6a, 6b or either one of the handles are operated by the user for tilting the sail portion A and for rotary movement of the sail portion A about the axis of strut 4.

An unfolding rope 15 connected at its one end to the lug 2a of slider 2 is extended to an intermediate portion of strut 4 through a first guide pulley 14a mounted to a side face of the head block 14. The other end of unfolding rope 15 is extended downward through one of cylindrical rope guides 4c attached to the opposite sides of strut 4. A red ball 16 is connected to the other end of unfolding rope 15, and a rubber string 21 is connected to the red ball 16. The rubber string 21 is inserted into the strut 4 through an opening 13 formed in the lower portion of strut 4, extended out of the

upper end of strut 4 and connected at its other end to the head block 14. The rubber string 21 is stretched with initial tension to lightly pull the red ball 16 downward. This serves to prevent the unfolding rope 15 from being caught in another when the sail portion A has been unfolded and to prevent the red ball 16 from being lost in sight. To prevent removal of the unfolding rope 15 in use of the sailing device, the first guide pulley 14a is enclosed with a cover 14b of sheet metal mounted to a side portion of the head block 14. The cover 14b may be replaced with a block of elastic ?????? positioned for slight engagement with the outer periphery of guide pulley 14a. In the case that the lower end portion of unfolding string 15 in an extent is formed of fiber reinforced plastic of appropriate bending stiffness and that a joint portion of the unfolding string 15 with the fiber reinforced plastic is placed without extending downward from the rope guide 4c in an unfolded condition of the sail portion, it is able to prevent the unfolding string from being caught in another and to prevent the red ball 16 from being lost in sight. A release rope 17 is connected at its one end to the stopper hook 9b and extended downward through another rope guide 4c. A blue ball 18 is connected to the other end of release rope 17. The red and blue balls 16 and 18 may be provided in the form of a different color and shape if they are conspicuous and easy to grip.

As shown in Fig. 11, a lug 2e of U-shape in cross-section may be fixed to the front end of slider 2 in stead of the flange 2d. In such a case, the hook portion of stopper 9b can be engaged with the slider 2 by engagement with a bolt 2f fastened to

the lug 2e.

In the first embodiment, the spars 3a, 3b are hingedly connected to the fore end of backbone 1 by means of the hinge brackets 3g, 3h for tilt movement. Illustrated in Fig. 12 is a modification of the hinge connection of spurs 3a, 3b, wherein a top-piece 8a of sailcloth is sewed to the fore end of sail cloth 8 at a portion where respective fore ends of the backbone 1 and spars 3a, 3b are assembled. The top-piece 8a is composed of a pair of first sheath portions 8b formed to cover each sheath portion of the fore end of sail cloth 8 and a second sheath portion 8c opened backward between the first sheath portions 8b. The sheath portions 8b, 8b are sewed to a flat portion of sail cloth 8 at their side portions respectively in such a manner as to form openings for insertion of each fore end of the backbone 1 and spars 3a, 3b and to form a closed end for retaining each fore end of the backbone 1 and spars 3a, 3b. The backbone 1 and spars 3a, 3b are connected to each other at their fore ends inserted into the first and second sheath portions 8b and 8c of elastic top-piece 8a for tilt movement and retained in position by end rubbers 28 hooked to each end-piece 25 at their aft ends. With the top-piece 8a, the backbone 1 and spars 3a, 3b can be assembled in a simple manner.

The sailing device is preserved in a closed condition. When it is desired to use the sailing device, the user fastens the belt 30 of adaptor B, inserts the lower end joint ball 10 of strut 4 into the socket 30b of adaptor B, holds the handles 6a, 6b to retain the

strut 4 in an approximately vertical position, and pulls down the unfolding rope 15 with the red ball 16 in a condition where the strut 4 is located at a windward side. With such operation, the slider 2 is pulled toward the stopper 9 at the fore portion of backbone 1, and the spars 3a, 3b and strut 4 are unfolded against the strut 4 by means of the three rods 5a, 5b, 5c in connection with the slider 2. When the slider 2 is engaged with the stopper 9, the stopper hook 9b is brought into engagement with the flange 2d of slider 2 to retain the spars 3a, 3b and strut 4 in the unfolded condition. In such a condition, the upper tension rope 13c connected to the intermediate portions of spurs 3a and 3b and the left and right tension ropes connected to each intermediate portion of spars 3a, 3b and the handle bracket 6c are stretched in a triangular arrangement without any loose to firmly retain the spars 3a, 3b and strut 4 in their unfolded positions relative to the backbone 1. Thus, the left and right wing sections of sail portion A are retained at a predetermined camber angle.

In this embodiment, the sailing device can be supported by a small force as it rises above the user like a kite. As shown in Fig. 18, the sailing device is supported at the front of the user's body and carried by the user's hands gripped the handles 6a, 6b in a condition where the lower joint ball 10 of strut 4 has been received by the socket 30b of adaptor B fastened to the user's body. When received a tail wind as shown an arrow W, the sail portion A is down the wind, and the fore side of sailing device A is directed to the windward. In such a condition, a resultant force F of lift forces vertically acting on the left and right wing sections of the sail portion A acts obliquely

upward on the center of sail portion A in width direction, and the sail portion A is pulled by a horizontal component Fh of the resultant force and lifted by a vertical component Fv of the resultant force F. The resultant force F is balanced with the weight of the sailing device in accordance with relative velocity of the wind to the sail portion A. When the angle of backbone 1 relative to the strut 4 is changed to adjust the position of the lower joint ball 10 of strut 4, the sailing device can be supported by the handles 6a and 6b with a small force. In such an instance, the horizontal component Fh is decreased by movement of the sail portion A toward the head side of the user and increased by downward movement of the sail portion A.

When the sail portion A is displaced leftward from the leeward at its aft end in a condition where the left and right wing sections of the sail portion A have been placed at the same height without lateral inclination, an angle of elevation to the wind increases at the left wing section of the sail portion A and decreases at the right wing section of the sail portion A. This results in an increase of the lift force at the left wing of the sail portion A and a decrease of the lift force at the right wing section of the sail portion A. In such an instance, the resultant force F of lift forces acting on the entirety of sail portion A is directed rightward. As a result, the aft end of sail portion A is pushed back to the leeward. Similarly, when the sail portion A is displaced rightward from the leeward at its aft end, the aft end of sail portion A is pushed back to the leeward. This is effective to enhance stability in the direction of the sailing device.

When the strut 4 is twisted with the handles 6a, 6b to incline the left wing section of sail portion A downward, the fore end of sail portion A is displaced leftward from the windward. In such an instance, the resultant force F acting on the entirety of sail portion A inclines leftward to cause a leftward horizontal component. The horizontal component causes a clockwise moment about the lower joint ball 10 of strut 4 in a plan view in the figure. As a result, the aft end of sail portion A is tilted leftward with the center at the joint ball 10. When the right wing section of sail portion A is inclined downward in a similar manner as described above, a counterclockwise moment will occur about the lower joint ball 10 of strut 4 in a plan view in the figure. As a result, the aft end of sail portion A is tilted rightward with the center at the joint ball 10. Such operation of the sailing device as described above can be trained on the ground as shown in Fig. 18.

In use of the sailing device on a boat, the angle of backbone 1 relative to the strut 4 is adjusted to 45° – 75° (desirably, 60°), and each camber angle of left and right wings of sail portion A is adjusted to 15° - 35° (desirably, 23°). With such adjustment of the angles, even when received an adverse wind obliquely from the front, it is able to sail the boat with the sail portion A the aft end of which is obliquely directed on the bow of the boat.

Hereinafter, sailing operations of a boat C with the sailing device will be

described with reference to Figs. 16 and 17. In use of the sailing device, a wind force acting on the sail portion A is transmitted to the boat through the lower join ball 10 received by the socket 30b of adaptor B fastened to the user's body. As the join ball 10 is rotatable on the socket 30b, only a resultant force acting on the sail portion A is transmitted to the adaptor B. The boat is equipped with a center board or a leeboard (not shown) for resisting to a lateral flow caused by a side-force.

When received a tail wind, the sailing device is used in such a manner that the sail portion A is retained without causing any lateral inclination. Assuming that the boat C is sailing before the wind at a speed Vr, the velocity of the wind acting on the sail portion A is defined by a difference between the velocity of the tail wind and the sailing speed Vr of the boat, and the resultant force Fr of lift forces vertically acting on the left and right wings of sail portion A acts obliquely upward on the central surface of sail portion A in a lateral direction. Thus, the boat C is sailed by a horizontal component Frh of the resultant force. When the sail portion A is tilted above the head of the user by operation of the handles 6a, 6a during sailing of the boat, the angle of elevation is decreased, and the horizontal component Frh is decreased in accordance with approach of the resultant force Fr to a vertical direction. When the sail portion A is tilted downward at its fore end, the angle of elevation is increased, and the horizontal component Frh is increased in accordance with approach of the resultant force to a horizontal direction. Thus, the sailing speed of the boat can be adjusted by such operation of the sailing device as described above.

When received a side wind in a condition where the sail portion A is retained without causing any lateral inclination and where the aft end of sail portion A is located leeward, the strut 4 is twisted in a counterclockwise direction by operation of the handles 6a, 6b so that the right wing of sail portion A is inclined downward to tilt the aft end portion of the sailing device about the socket 30b of adaptor B in a counterclockwise direction. With such operation, the strut 4 is approached to the sailing direction of the boat C as shown in Fig. 17(b). Assuming that the boat C is sailing at a speed Va in such a condition as described above, the wind to the sail portion A is changed by influence of the sailing speed as shown by an arrow Wal, and the horizontal component of the resultant force of lift forces vertically acting on left and right wings of the sail portion A becomes as shown by an arrow Fah and is transmitted to the socket 30b of adaptor B fastened to the user's body through the lower join ball 10 of the strut 4. Thus, the boat is sailed by a forward component Faf of the horizontal component Fah at the speed Va. In such an instance, the lateral flow of the boat caused by a lateral component Fas is prevented by the center board or leeboard (not shown), and the sailing speed Va of the boat can be controlled by operation of the handles 6a, 6b for adjustment of the sail portion A.

When received an adverse wind obliquely from the left front of the boat C as shown by an arrow Wc, the fore end of backbone 1 is approached to the sailing

direction of the boat C more than that in the side wind described above. Assuming that the boat C is sailing at a speed Vc in such a condition as described above, the wind to the sail portion A changes in accordance with the sailing speed as shown by an arrow Wc1, and the horizontal component of the resultant force of lift forces vertically acting on left and right wings of the sail portion A becomes as shown by an arrow Fch. Thus, the boat C is sailed by the horizontal component Fch at the speed Vc. With such operation of the sailing device

When received an adverse wind obliquely from the left front as shown by an arrow Wc, the use causes the fore end of backbone 1 to approach in the sailing direction of the boat more than that in the side wind described above. Assuming that the boat C is sailing at a speed Vc, the wind to the sail portion A is changed by influence of the sailing speed as shown by an arrow Wcl, and the horizontal component of the resultant force of lift forces vertically acting on the left and right wings of sail portion A becomes as shown by an arrow Fch. Thus, the boat C is sailed windward at the speed Vc by the horizontal component Fch across the adverse wind. In such an instance, the lateral flow of the boat caused by a lateral component Fcs is prevented by the center board or leeboard (not shown), and the sailing speed Vc of the boat can be controlled by operation of the handles 6a, 6b for adjustment of the sail portion A.

When it is desired to finish the sailing, the front handle 6a is directed

windward to eliminate the lateral inclination of the sail portion A, and the fore end of sail portion A is directed just windward. In such a condition, the blue ball 18 is pulled to draw the release string downward thereby to disengage the stopper hook 9b from the front flange 2d of slider 2 against a resilient force of stopper rubber 9a. Thus, the left and right spars 3a, 3b are moved by tension of the sail cloth 8 toward their fold positions, and the slider 2 is retracted by the left and right rods 5b, 5c such that the strut 4 is moved to its fold portion. Subsequently, the handles 6a, 6b are folded upward along the strut 4, and the spars 3a, 3b and strut 4 are further approached to the backbone 1 so that the sailing device is folded in the form of a single pole. The folded sailing device is removed from the socket 30b of adaptor B and fallen on the front deck of the boat C to avoid disturbance in use of paddles or oars for rowing the boat and to lower the gravity of the boat.

In this kind of sailing devices, desired operations may not effected due to deterioration of stability of the sail portion A in a fore-and-aft direction when received a high wind. This is caused by decrease of an angle of elevation to the high wind applied to the sail portion A. When the angle of elevation to the wind decreases, each lift force acting on the wings of sail portion A displaces to aft sides of the wings, resulting in further decrease of the angle of elevation finally to a negative angle. Such a problem can be solved by fastening the aft portion of sail cloth 8 to the backbone 1 by means of strings passed through ear pieces 8e, 8f fixed to the aft portion of sail cloth 8 as shown in Fig. 10. In the case that the aft portion of sail cloth 8 is fastened to

the backbone 1, the sail cloth 8 is filled with the wind at the fore side of ear pieces 8e, 8f, while the aft portion of sail cloth 8 is retained along the boackbone 1 even when received the high wind. Accordingly, the displacement of the acting position of lift forces toward the aft side becomes small. This is effective to ensure the normal function of the sailing device. Even when the angle of elevation tends to decrease to a negative angle, the wind applied to an upper surface of the aft portion of sail cloth 8 along the backbone 1 acts to push back the sail portion A to a normal condition. This is effective to enhance the stability of the sailing device in the fore-and-aft direction in a high wind.

In a condition where the aft portion of sail cloth 8 is fastened to the backbone 1 by means of the string, a propulsive force of the sail portion A decreases due to decrease of lift forces acting on the wings of sail portion A. This results in decrease of the sailing speed of the boat C. Accordingly, when received a gentle wind, the sailing device is used in a condition where the string fastening the aft portion of sail cloth 8 to the backbone 1 was released.

Hereinafter, a second embodiment of the present invention will be described with reference to Figs. 13 and 15. In this embodiment, only the lower end portion of strut 4 and the aft section of sail portion A are different from those in the first embodiment. In the second embodiment, the joint ball 10a fixed to the lower end of strut 4 in the first embodiment is replaced with a universal joint foldable in whole

directions using a rubber element. A plug body 11 of U-shape in cross-section is mounted to the universal joint 10a for rotary movement about a vertical axis. A U-letter shaped leaf spring 11b coupled with the plug body 11 has a projection 11a caulked thereto. The projection 11a of leaf spring 11b is engaged with a corresponding hole in one side of plug body 11 in such a manner that the tip of projection 11a stands out of the corresponding hole to be pushed inward against the resilient force of leaf spring 11b. A tubular socket 12 of square in cross-section is mounted on the boat hull to receive the plug body 11. When the plug body 11 is inserted into the socket 12, the sailing device is firmly mounted on the boat hull by engagement of the projection 11a of leaf spring 10b with the corresponding hole of plug body 11. When the projection 11a is pushed inward, the sailing device can be easily removed from the socket 12.

In this second embodiment, as shown in Figs. 13 and 14, the backbone 1 is provided at its aft portion with lower and upper ribs 7a and 7b. The lower rib 7a is in the form of a pipe of small diameter which is connected to a metallic lower rib link plat 7c at its one end. The lower rib link plate 7a is inserted into a longitudinal slit of backbone 1 and pivoted at its intermediate portion to a bolt 7e passed through the backbone 1 and fixed in place by means of a fastening nut. The upper rib 7b is pivoted to an upper portion of the lower rib link plate 7a projected upward from the longitudinal slit by means of a bolt 7c. A metallic ancillary link plate 23 is inserted into another longitudinal slit of the backbone and pivoted to a bolt 7f passed through the backbone 1 and fixed in place by means of a fastening nut. The upper rib 7b is

pivoted at its intermediate portion to an upper portion of the ancillary link plate 23 by means of a bolt 7g. A tail-cloth 22 is pitched between the lower and upper ribs 7a and 7b, and a tail string 19 is connected at its opposite ends to a rear end of lower rib 7a and to the distal end of handle 6b. When the sail portion A is unfolded, the tail string 19 acts to draw the lower rib 7a downward, and the tail-cloth 22 is unfolded in the form of a vertical tail-wing to enhance stability in directional stability of the sailing device. When the sailing device is folded, the tail string 19 is loosen, and the tail-cloth is folded.

As shown in Fig. 13, a fixing piece 24a is secured to the central rear portion of sail-cloth 8, and a tension rubber ring 24 is hooked with the fixing piece 24a to hang the backbone 1 on the sail-cloth 8. With the rubber ring 24, the sail-cloth 8 is drawn downward to the backbone 1 to enhance vertical stability of the sailing device in the strong wind. When receives a gentle wind, the tension rubber ring 24 is removed from the fixing piece 24a to increase a propulsive force. When the ancillary link plate 23 is replaced to increase an angle of the upper rib 7b, the vertical stability of the sailing device is obtainable even in the strong wind.

In a modification shown in Fig. 15, a fixing piece 24b is secured to the central rear portion of sail-cloth 8, and a pull-down rope 27 is connected at its one end to the fixing piece 24b and extended toward a second pulley 14c through a guide pipe 26

under the backbone 1. The pull-down rope 27 further extended through the second pulley 14c is connected at its other end to a cleat 29 which is mounted to an intermediate lower portion of strut 4. With provision of the pull-down rope 27, it is able to adjust the pull-down degree of the sail portion A at its aft portion during sailing of the boat for adjustment of the vertical stability and propulsive force of the sailing device.

In the embodiments described above, the rods 5a, 5b and 5c are pivoted at their one ends to the intermediate portions of strut 4 and spars 3a, 3b and at their other ends to the slider 2 on the backbone 1. With such arrangement of the respective rods, the sailing device can be folded in the form of a single pole. This is useful to facilitate preservation of the sailing device.